Relative Quadrupole Moments of ^{192,193}Hg Superdeformed Bands.

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Relative quadrupole moments (Q_o's) of yrast and excited SD bands can give insight into the deformation–driving effects of specific nucleon configurations and aid in the interpretation of "identical" bands. A pair of "identical" bands will have transition energies that are equal to, or are at the quarter points or half points of, each other. A clear understanding of this phenomenon has yet to be developed. With this in mind, SD states in ^{192,193}Hg were populated simultaneously via the ^{176}Yb(^{22}Ne,xn) reaction at a beam energy of 118 MeV. The target consisted of a 500 μg/cm^2 ^{176}Yb foil evaporated on a 6.8 mg/cm^2 Au backing. The beam was accelerated by the 88–Inch Cyclotron at Lawrence Berkeley National Laboratory, and γ rays were detected by the Gammasphere array which, for this experiment, had 85 Ge detectors. A total of 1.9×10^9 events with a fold ≥ 5 were collected. A Doppler Shift Attenuation Method (DSAM) centroid shift analysis was then performed.

Experimental fractional Doppler shifts, F(τ), were extracted and are shown in the figure for the ^{192}Hg and ^{193}Hg SD yrast bands. Calculated F(τ) curves, that assume a rotational cascade and constant Q_o(Q_{sf}) for the in-band(sidefeeding) states, are shown for comparison. The stopping powers of Ziegler were used. A lineshape analysis on some transitions in the ^{192,193}Hg SD bands was also performed, leading to results consistent with the F(τ) analysis. Comparing the F(τ) curves allowed several important conclusions. The relative Q_o's of the yrast SD bands of ^{192}Hg and ^{193}Hg are different to a significance $> 2\ \sigma$, with values of 19.8 $\pm$ 1.2 eb and 17.2 $\pm$ .7 eb respectively. The uncertainty in the sidefeeding time, obtained by χ^2 minimization, has been included in the Q_o errors. Nevertheless, radically different sidefeeding in the two SD Hg nuclei could cause the apparent Q_o difference, although this solution is less likely. Based on current theoretical work, the difference between ^{192}Hg and ^{193}Hg is unexpected. The experimental Q_o's of all six SD bands in ^{193}Hg are the same to $\approx 1\ \sigma$, which seems to eleminate a large polarizing effect of the different single particle levels. This similarity in Q_o is difficult to reconcile, given the difference in the ^{192}Hg and ^{193}Hg Q_o's. Since ^{192}Hg and ^{193}Hg have a SD "identical" band relationship, the data may imply that "identical" transition energies don't always lead to identical deformations. This is the first accurate measurement of Q_o's in an odd-mass SD nucleus in the mass 190 region.